



Southern Forest Health Research and Management Update



Fall 2017

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Science and Program Highlights

Exploring the impact of an insect-killing fungus on the small southern pine engraver *Ips avulsus*

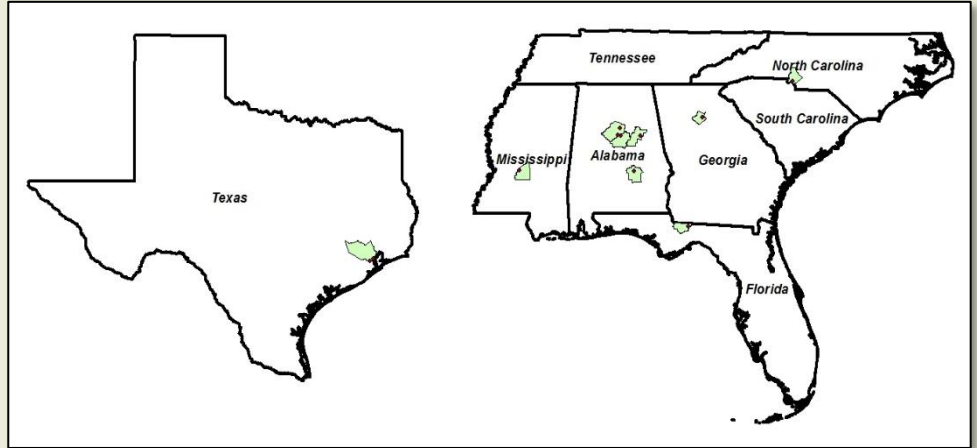
A study investigating the effect of a commercial preparation of the entomopathogenic (=insect-killing) fungus *Beauveria bassiana* in protecting pines from colonization and damage by *Ips avulsus* was conducted in the Kisatchie National Forest in Louisiana using a small bolt technique. The primary goal was to evaluate effects of *Beauveria bassiana* on small southern pine engraver (*I. avulsus*) mortality during the first 2 weeks of host attack. The results indicate that although the formulation did not protect bolts from attack, it caused high mortality of *I. avulsus* adults and significantly reduced the number of adults that re-emerged. The high rates of beetle mortality observed under the bark suggest potential utility of the formulation for managing pine bark beetles. However, successful application strategies and tactics are unknown at this point and will depend on future studies and many factors, including deployment techniques, longevity and viability of spores, horizontal transmission of infection, and the extent of adult exposure to spores on the bark during host attack. For more information, contact **Rabiu Olatinwo** (rolatinwo@fs.fed.us).



Photo caption: Site of field trials at the Kisatchie National Forest, Rapides Parish, LA (a) Lindgren funnel trap baited for *Ips avulsus* (b) Adult *Ips avulsus* dead from *Beauveria bassiana* infection (c). Photos courtesy of Rabiu Olatinwo.

Update on Sudden Oak Death (SOD) Pathogen Early Detection Stream Survey

The presence of *Phytophthora ramorum*, causal agent of sudden oak death (SOD), has been confirmed in eleven states in the Southern Region (R8) after nationwide shipment of infected nursery plants from CA in 2003. To monitor introduction and movement of the pathogen in eastern states, a terrestrial survey was initiated in 2003; the more efficient stream survey started in 2007. Since the pathogen can escape from infested nurseries via run-off water, the survey focuses on streams associated with *P. ramorum* positive nurseries. Streams in areas with high demand for nursery plants or with wholesale nurseries also were selected as survey sites. Since 2007, the pathogen has been detected from twelve streams in R8 (see map). Currently, eight R8 states are participating in the stream survey—AL, FL, GA, MS, NC, SC, TN, and TX. Of 57 streams surveyed this spring, three streams in AL, MS, and NC were positive for *P. ramorum*. The pathogen has been detected repeatedly from these streams that contain run-off water from the adjacent positive nurseries; however, infestation of streamside plants has not been reported. The survey will resume in the fall when water temperatures reach the range for pathogen detection. For more information, contact **Jaesoon Hwang** (jaesoonhwang@fs.fed.us).



Phytophthora ramorum positive streams in Region 8 (2007-2017). All streams were associated with *P. ramorum* positive nurseries.

Southern Pine Beetle Strikes Multiple States This Year

The South is currently experiencing a multi-state southern pine beetle (SPB) outbreak for the first time since 2003. Officially, 18 counties are in outbreak status across the following states: Mississippi, Alabama, North Carolina, and Georgia. In the previous 15 years however, South-wide SPB activity had been unusually low, causing some scientists and forest managers to wonder why populations had declined to their lowest levels since record keeping began in 1960. For some historical context, between 1960-2003 there were only 12 individual years for which there were fewer than 50 SPB outbreak counties reported, and no more than two consecutive years where outbreak numbers were that low. This recent, sustained period of reduced activity has allowed forest managers to focus on SPB prevention practices, such as thinning and longleaf pine restoration (with more than 1.2 million acres treated). These practices have proven effective with more than 85-90% of spots occurring in untreated areas in most situations. However, there are still millions of acres of loblolly and shortleaf pine South-wide that need thinning or, to a lesser extent, could be restored to longleaf.

The current outbreak of SPB is primarily impacting the National Forests in Mississippi, Alabama and central Georgia. While impacts to Mississippi have been most severe this year, there is growing concern that the SPB situation on the National Forests in Alabama and the Oconee National Forest in Georgia could become as serious if not addressed quickly. Private lands are also being impacted by SPB, most significantly in southwest and south-central Alabama and lands within or adjacent to National Forest boundaries in Mississippi. To a much lesser extent, scattered SPB activity on National Forest and private lands has been found in Georgia, Florida, North Carolina, South Carolina and Louisiana this year. To date, almost 11,000 spots exceeding 13,000 acres of mortality have been detected across the region. For more information, contact **Don Duerr** (dduerr@fs.fed.us).

In the News

“TIME 4 Real Science” program connects high school students with forest research

On August 7, 2017, high school students and teachers from western North Carolina converged on the DuPont State Forest for some hands-on field research and discussion with USDA Forest Service and NC State University scientists. The event was part of the “TIME 4 Real Science” program, a student-led, science inquiry course and extracurricular activity in which students interact with scientists from a variety of disciplines and also develop their own independent research projects. At DuPont, the students joined **Bud Mayfield** and **Bryan Mudder** (USDA-FS Southern Research Station) and **Andy Whittier** (NC State/Camcore) to collect vegetative cover data in research plots evaluating restoration techniques for eastern hemlock, a native tree threatened by the invasive hemlock woolly adelgid. The field work was coupled with a classroom discussion in which the students and scientists examined the objectives, methods, and results of a related scientific journal article. The program was founded in 2006 by **Jennifer Williams** and **Mary Arnaudin** and is a partnership of Transylvania County Schools and 4H Youth Development. For more information, contact Bud Mayfield

(amayfield02@fs.fed.us).



High school students in western North Carolina used square meter sampling frames (above) to measure percent cover of forest vegetation on hemlock restoration research plots with USDA Forest Service and NC State University scientists (left). Photos by Jennifer Williams.

SRS 4552 participates in Experimental Forests Network tour

In September, **Dr. Rabiou Olatinwo** and **Bryan Mudder** (both from SRS 4552) participated in the Southern Research Station (SRS) Experimental Forest (EF) Network Tour to explore research collaboration opportunities across the network of SRS experimental forests. The five-day tour included eight experimental forests located in Arkansas, Louisiana, Mississippi, and Texas. Rabiou, along with **Stephanie Laseter**, **Dana Nelson**, and **Ge Sun** toured the Stephen F. Austin, Palustris, Crossett, and Delta Experimental Forests. Bryan, along with **Jim Vose**, **Jennifer Knoepp**, and **Mac Callaham**, traveled to the Alum Creek, Koen, Sylamore, and Tallahatchie Experimental Forests. On the final day, the two teams and hosts converged in Oxford, MS to share experiences with each other and with SRS director Rob Doudrick. For more information about the Experimental Forest tour and network, contact **Stephanie Laseter** (slaseter@fs.fed.us).



Rabiou Olatinwo, Stephanie Laseter, Dana Nelson, and Ge Sun touring the Delta Experimental Forest.

SRS shares insect science at annual “BugFest” in Raleigh, NC



SRS resource information specialist Erika Mack shows magnified insect specimens to a young science enthusiast at “BugFest”. Photo by Clynt Dudleson.

On September 17, more than 35,000 insect enthusiasts gathered for “BugFest” at the North Carolina Museum of Natural Sciences in Raleigh, NC. Hundreds of children and adults stopped by the SRS table to learn about research and to see insects up close. SRS research entomologists **Bud Mayfield**, **Dan Miller**, and **JT Vogt** provided insect specimens – and digital microscopes so participants could get a closer look. Most of the specimens were insects beneficial to forest management, including predators of pine bark beetles and of the hemlock woolly adelgid. SRS resource information specialist **Erika Mack** and research ecologist **Frank Koch** co-organized SRS participation, and were assisted at the event by SRS science writer **Sarah Farmer** and Kisatchie National Forest employee **Stacy Blomquist**. “My favorite interaction at BugFest was with an eight year old boy,” says Mack. “We talked

about how destructive the southern pine beetle is, and why we call it a bad bug,” says Mack. “The child didn’t agree. He pointed out that beetles eat pine trees because they’re hungry, and how does that make them bad bugs?” Further dialogue did not sway the young insect enthusiast. “Sharing our research with the public is important,” says Koch. “I think many of the folks who stopped by will remember us and retain what they learned about Forest Service research.” In addition to the conversations and the insect specimens, children enjoyed crafting. They also appreciated the goody bags, which contained copies of the Forest Service science journal, the Natural Inquirer.

For more information, email **Erika Mack** at emack@fs.fed.us. - adapted from story by Sarah Farmer, SRS.

SRS and FHP scientists engage with State Foresters in Biloxi, MS

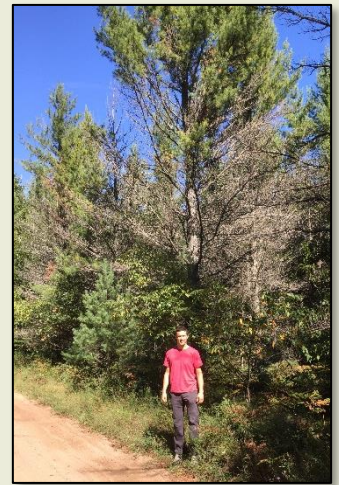
In August, state foresters from Alabama, Louisiana, and Mississippi, along with their staffs and personnel from the U.S. Forest Service Southern Research Station (SRS), gathered in Biloxi, MS. This was the third State Line Meeting for state foresters Wade Dubea of Louisiana and Charlie Morgan of Mississippi, and the first for Alabama State Forester Rick Oates. Several scientists gave brief state-of-the-knowledge presentations to kick off discussions. SRS research entomologist **Brian Sullivan** shared the current state of knowledge about southern pine beetle (SPB) controls, including chemical controls and mechanical suppression. He also discussed the knowledge gaps related to beetle outbreaks, which includes uncertainty around SPB population crashes, biology of the species during endemic periods, and causes of population shifts between endemic and epidemic levels. Brian also presented an overview of the status of emerald ash borer, redbay ambrosia beetle, and *Ips* pine engraver. FHP entomologist **John Nowak** focused on the current SPB outbreak in Mississippi, including measures being taken to control the outbreak on public lands and prevent its spread to state and private lands. As a solution to the current supply issue, national forests are working with States to engage the logging and forest operations community to help move the volume of wood being removed to new markets. The Southern Region has partnered with the agency’s Geospatial Technology and Applications Center (GTAC) to develop a new remote sensing tool that will aid in identifying SPB infestation hot spots and allow ground crews to reach those areas quickly to prevent the spread to healthy trees. - adapted from article by Stephanie Laseter, SRS.

White Pine Health workshop to be hosted in Athens, GA

Mark your calendars! The White Pine Health in Eastern Timberlands Workshop will be hosted February 6-9, 2018, in Athens, GA. The goal is to form a cohesive team of personnel from diverse backgrounds, fields, agencies, and regions who are directly involved in studying and managing various aspects of abiotic and biotic stressors affecting white pine resilience and integrity. For more information, contact **Kamal Gandhi** (kgandhi@warnell.uga.edu), **Bill Livingston** (WilliamL@maine.edu), or **Rima Lucardi** (rlucardi@fs.fed.us)

At right: Thomas Whitney's PhD research seeks to understand the possible causes of a dieback phenomenon in eastern white pine, pictured in background.

--Image courtesy of TD Whitney.



Technology Transfer

Publications (in print/press):

1. Bracewell, R.R., B.J. Bentz, B.T. Sullivan, and J.M. Good. 2017. **Rapid neo-sex chromosome evolution and incipient speciation in a major forest pest.** *Nature Communications* 8: 1593. doi:10.1038/s41467-017-01761-4.
2. Armendáriz-Toledano, F., García-Román, J., López, M., Sullivan, B., & Zúñiga, G. 2017. **New characters and redescription of *Dendroctonus vitei* (Coleoptera: Curculionidae: Scolytinae).** *The Canadian Entomologist* 149: 413-433. doi:10.4039/tce.2017.10.
3. Castrillo, L.A., A.E. Mayfield III, M.H. Griggs, R. Camp, B. Mudder, A. Taylor, and J.D. Vandenberg. 2017. **Mortality and reduced brood production in walnut twig beetles, *Pityophthorus juglandis* (Coleoptera: Curculionidae), following exposure to commercial strains of entomopathogenic fungi *Beauveria bassiana* and *Metarhizium brunneum*.** *Biological Control* 114: 79-86.
4. Miller, D.R., C.M. Crowe, P.D. Mayo, P.J. Silk, L. Reid, and J.D. Sweeney. 2017. **Interactions between ethanol, hexanediol and hydroxyketone lures on trap catches of hardwood woodborers in southeast USA.** *J. Econ. Entomol.* 110: 2119–2128.
5. Miller, D.R., and C.M. Crowe. 2018. **Effects of distance between baited multiple-funnel traps on catches of bark and wood boring beetles in north-central Georgia.** *J. Entomol. Sci.* In press.
6. Olatinwo, R., S. Walters, and B. Strom. 2017. **Impact of *Beauveria bassiana* (Ascomycota: Hypocreales) on the small southern pine engraver *Ips avulsus* (Eichhoff) in a loblolly pine bolt assay.** *Journal of Entomological Science* (in press).

Submitted Publications (in review):

1. Chase, K.D., L.D. Stringer, R.C. Butler, A.M. Liebhold, D.R. Miller, and E.G. Brockhoff. **Multiple-lure surveillance trapping for Scolytinae, Cerambycidae and brown marmorated stink bug.** *J. Pest Sci.*
2. Fraedrich, S.W., T. C. Harrington, S. J. Zarnoch, J. L. Hanula and G. S. Best. **Host colonization and factors affecting reproduction of *Xyleborus glabratus* in redbay and other species in the Lauraceae.** *Forest Science.*
3. Lapham, M., C. Miniati, A. Mayfield, R. Jetton, S. Brantley, D. Zietlow, C. Brown, R. Rhea. **Shade and hemlock woolly adelgid infestation increase eastern hemlock foliar nutrient concentration.** *Forests.*
4. Mayfield, A.E. III, J. Audley, R. Camp, B.T. Mudder, and A. Taylor. **Bark colonization of kiln-dried wood by the walnut twig beetle: effect of wood location and pheromone presence.** *J. Econ. Entomol.*
5. Miller, D.R., C.M. Crowe, M.D. Ginzel, C.M. Ranger, and P.B. Schultz. **Comparison of baited bottle and multiple-funnel traps for ambrosia beetles (Coleoptera: Curculionidae: Scolytinae) in eastern USA.** *J. Entomol. Sci.*

6. Olatinwo, R., W. Johnson, and T. Schowalter. **Genetic variation among *Amylostereum areolatum* (Russulales: Amylostereaceae) associated with the native North American woodwasp *Sirex nigricornis* Fabricius in Louisiana.** PLOS ONE.
7. Schulz, A.N., A.M. Mech, C. Asaro, D.R. Coyle, M.M. Cram, R.D. Lucardi, and K.J.K. Gandhi. **Assessment of abiotic and biotic factors associated with eastern white pine (*Pinus strobus* L.) dieback in the southern Appalachian Mountains.** For. Ecol. Manage.
8. Shih, H. H., C. E. Wuest, S. W. Fraedrich, T. C. Harrington, C. Y. Chen. **Assessing the susceptibility of Asian species of Lauraceae to the laurel wilt pathogen *Raffaelea lauricola*.** Taiwanese Journal of Forest Science.
9. Whitney, T.D., M.M. Cram, B.F. Barnes, J. Yao, R.D. Lucardi, and K.J.K. Gandhi. **Tree-level distribution of a novel insect-pathogen complex and its potential contribution to eastern white pine dieback.** For. Ecol. Manage.
10. Staeben, J.C., D.R. Miller, J.T. Nowak, and K.J.K. Gandhi. **Multi-trophic interactions mediated by semiochemicals within the southern pine bark beetle guild.** Agric. For. Entomol.
11. Sumpter, K., T. McAvoy, C. Brewster, A. Mayfield III, S. Salom. **Assessing an integrated biological and chemical control strategy for managing hemlock woolly adelgid in southern Appalachian forests.** For. Ecol. Manage.

Presentations and Lectures:

1. Castrillo, L., A. Mayfield, M. Griggs, R. Camp, B. Mudder, A. Taylor, and J. Vandenberg. 2017. **Mortality and reduced brood production in walnut twig beetles following exposure to commercial strains of entomopathogenic fungi *Beauveria bassiana* and *Metarhizium brunneum*.** 58th Southern Forest Insect Work Conference, 25-28 July 2017, Melbourne, FL (Poster).
2. Jetton, R.M., A.E. Mayfield, W.A. Whittier, B. Mudder, R. Rhea, and G. Hodge. **Silvicultural and Genetic Resource Conservation Strategies for Management of the Hemlock Woolly Adelgid.** 58th Southern Forest Insect Work Conference, 28 July 2017, Melbourne, FL.
3. Jubb, C., A. Mayfield, G. Wiggins, J. Grant, J. Elkinton, T. McAvoy, J. Lombardo, B. Mudder, and S. Salom. 2017. **Impact of predatory beetle, *Laricobius nigrinus* on HWA in the eastern U.S.: Phase 2.** 58th Southern Forest Insect Work Conference, 26 July 2017. Melbourne, FL.
4. Lucardi, R.D., A.N. Schulz and T.D. Marsico. 2017. **Strengthening the ties that bind: An examination of cross-disciplinary communication between the fields of invasion ecology and biocontrol using evaluative bibliometrics.** 58th Southern Forest Insect Work Conference. July 2017. Melbourne, FL.
5. Mayfield, A. 2017. **Some food for thought on the integrated pest management of hemlock and HWA.** 58th Southern Forest Insect Work Conference, 28 July 2017, Melbourne, FL.
6. Mayfield, A., S. Brantley, C. Brown, C. Brownie, C. Coots, J. Elkinton, J. Grant, A. Galloway, J. Hanula, N. Havill, A. Heminger, G. Hodge, K. Hoover, R. Jetton, S. Joseph, C. Jubb, T. Keyser, J. Lombardo, T. McAvoy, C. Miniati, K. Motley, B. Mudder, A. Neidermeier, B. Reynolds, D. Ross, J. Rhea, S. Salom, A. Tait, K. Wallin, M. Whitmore, W. Whittier, G. Wiggins, D. Zietlow. 2017. **Hemlock woolly adelgid research: update from the Southern Research Station.** 3rd Annual Hemlock Woolly Adelgid Program Managers Meeting, 2 Aug 2017, Chattanooga, TN.
7. Olatinwo, R. and T. Schowalter 2017. **Analysis of *Amylostereum areolatum* (Russulales: Amylostereaceae) symbiont from two populations of *Sirex nigricornis* Fabricius (Hymenoptera: Siricidae).** Presented at the 2017 American Phytopathological Society Annual Meeting in San Antonio (August 5-9 2017).
8. Shepherd, W.P. and B.T. Sullivan. 2017. **Re-examining the synergistic effects of trans-verbenol for attracting southern pine beetle.** 58th Southern Forest Insect Work Conference, 25-28 July 2017, Melbourne, FL (Poster).
9. Sweeney, J., P. Silk, R. Webster, C. Hughes, P. Mayo, J.M. Gutowski, T. Mokrzycki, D. Miller, K. Ryall, M. Qingfan, L. Yan, and J. Francese. 2017. **Recent improvements in trapping methods for surveillance of bark and wood boring beetles.** IUFRO Congress, Freiburg, Germany.
10. Sweeney, J., P. Silk, R. Webster, L. Flaherty, G. Pohl, C. Hughes, K. Van Rooyen, P. Mayo, J.M. Gutowski, T. Mokrzycki, D. Miller, K. Ryall, M. Qingfan, L. Yan, and J. Francese. 2017. **Using a diversity of trap heights, lures, and colors increases species richness in survey traps for wood boring beetles.** Joint Meeting of IUFRO Working Parties 7.03.05 and 7.03.10. Thessaloniki, Greece.

11. Villari, C., N.J. Workman and S.W. Fraedrich. 2017. **Use of LAMP for in-field early detection of *Raffaelea lauricola*, the causing agent of laurel wilt disease.** 5 – 9 August, 2017. American Phytopathology Annual Conference, San Antonio, TX.
12. Villari, C., N.J. Workman, S.W. Fraedrich. 2017. **Molecular help in your backpack: in-field early detection of laurel wilt using lamp. IURFO: Methodology of forest insect and disease survey.** 11-15 September, 2017. Thessaloniki, Greece.
13. Wallin, K.F., K. Motley, A. Neidermeier, D.W. Ross, N.P. Havill, K. Hoover, A.E. Mayfield, and M.C. Whitmore. **Reproduction of silver flies (Diptera: Chamaemyiidae) from the western USA on *Adelges tsugae* (Hemiptera: Adelgidae) in the eastern USA.** 58th Southern Forest Insect Work Conference, 27 July 2017, Melbourne, FL.
14. Workman, J. N., S. W. Fraedrich, and C. Villari. 2017. **Development of a LAMP-based assay for rapid in-field detection of *Raffaelea lauricola*, the causal agent of laurel wilt disease.** Mycological Society of America Conference. Athens, GA, July, 2017.
15. Workman, J. N., S. W. Fraedrich and C. Villari. 2017. **Rapid in-field early detection of the causal agent of laurel wilt disease through a LAMP based molecular assay.** The 58th Annual Southern Forest Insect Work Conference. July 25-28, 2017, Melbourne, FL.

USDA Forest Service

Forest Health Protection, Southern Region

<http://www.fs.usda.gov/main/r8/forest-grasslandhealth>

Southern Research Station

RWU 4552: Insects, Diseases and Invasive Plants of Southern Forests

<http://www.srs.fs.usda.gov/idip/index.html>

